

## **VAMOS Ocean-Cloud-Atmosphere-Land Study (VOCALS)**

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The VOCALS program aims to the increased understanding of the South East Pacific (SEP) climate. The approach emphasizes the interactions among major climate components: atmosphere, ocean, clouds, and the aerosol. The key VOCALS objectives are (1) the elimination of coupled GCM systematic errors in the SEP, and improved model simulations of the coupled system in the region and global impacts of its variability; and (2) improved understanding and regional/global model representation of aerosol indirect effects over the SEP. The program has modeling, empirical, and field components. The latter consists of extended monitoring (IMET buoy since 2000), seven research cruises and an intensive field phase (VOCALS Regional Experiment, REx) that took place in the Fall of 2008. VOCALS grew out within the VAMOS panel following the East Pacific Investigation of Climate (EPIC) program. At the present time, VOCALS is in the post-field science analysis and synthesis phase. The presentation will discuss the key science goals of the program and the extent to which these goals are being met.

VOCALS works with a range of models including SCM, LES, regional models (WRF), and general circulation models (GCMs). SCMs are indicating the sensitivity to parameterization changes and help guide model development. SCMs, LES and WRF-Chem are being used to examine the aerosol indirect effect on boundary layer clouds. WRF studies have revealed the existence of different contributions to the SEP diurnal cycle originating from the Chilean and Peruvian land-masses. Analyses of GCM output, confronted with VOCALS observations, have clarified quantitatively the erroneous way in which models reproduce the sea surface temperature underneath the stratocumulus decks in the SEP.

Two of the current CPT projects are using VOCALS understanding to improve the representation of the cloudy boundary layer in models. One focuses upon the NCEP GFS and NCAR CAM5 driven by a need to improve the subtropical stratocumulus to cumulus (Sc-Cu) transition. A second is attempting to unify the boundary layer turbulent mixing, shallow convection, and stratiform cloud parameterization schemes in climate models to improve the representation of aerosol indirect effects. Recent modeling studies have compared the SEP to the southeastern Atlantic revealing the uniqueness of those two regions. However, no project has been funded as yet to test hypotheses on the ocean role in the SEP by conducting research with very high resolution OGCMs.

Observations from VOCALS-REx are providing the most comprehensive picture of the macrophysical and aerosol structure of a subtropical stratocumulus sheet acquired to date. In part, is due to a different approach to aircraft sampling that emphasizes repeated measurements along a fixed ground track over the month-long period. One of the key conceptual shifts that VOCALS can take some considerable credit for is the realization of just how important precipitation is for controlling the dynamics and structure of the stratocumulus-topped marine boundary layer. Because precipitation in these clouds is susceptible to changes in atmospheric aerosol, and because precipitation can exert first order effects on cloud structure and albedo, VOCALS observations and the associated large eddy modeling are providing important new constraints for modeling aerosol-cloud interactions across scales.

A key topic of discussion at last year's Summit was the issue of there not being enough funding to analyze the data fully. VOCALS has the potential to produce a number of important "model-ready" datasets. Indeed, some of this activity is taking place, but as funding runs out (most US grants ran from 2008-2011), synthesis dataset creation becomes more difficult. Packaging data and providing adequate metadata for such datasets is not something that comes naturally to individual investigators (it is also time consuming and better organized centrally), and it is recommended that in future, archive centers such as NCAR EOL might be given funds to encourage the greater translation of observations into synthesized datasets for major observational programs.